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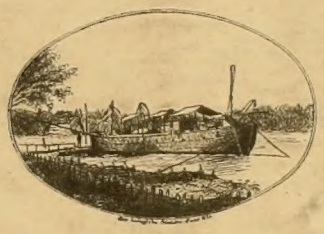

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VI.

1895.

By

C. G. Joh. Petersen,
Ph. D.

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1897.

Professor Th. N. Gill. M.D. Ph.D.
With the author compliments

From

The Danish Biological Station.

VI.

1895.

Kjøbenhavn.
Centraltrykkeriet.
1896.

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LIMFJORDEN.

Centraltrykkeriet

I. The yearly immigration of young plaice into the Limfjord from the German Sea. — The yearly fishing-up in the Fjord, of the fish over the size limit. — How to get a considerably increased income from this plaice fishery, which is now estimated at c. 300,000 Kroner a year, by the transplantation of young plaice.

(With 2 Tables and 3 Appendixes.)

By C. G. Joh. Petersen.

1896.

Analytical Index.

The plaice is a new-comer in the Fjord. — It is found particularly in the western part, from which reason the investigations are limited to this part. — A few large ripe plaice are found. — The fry of the year (1895) is missing in the whole Fjord in spring; the fry of 1894 is most frequently found towards the south and west. — The fry of the year 1895 was found in June, but only at Thyborøn. — The plaice does not breed in the Fjord properly so called; but the fry of the year (the 0-group) immigrates in the course of the year. — On the occurrence of the I and II-group and their migrations towards the east. — In all the expansions of the Fjord the fishery is chiefly based on the largest specimens of the II-group. — On an average this II-group gives larger fish in the Liv and Thisted expansions (»Bredning«) than in the more southern and western parts. — A strongly marked III-group is missing everywhere, only a few specimens of it are found. — On the small number of plaice in the waters west and north of Mors (Thisted-Bredning); here are found only »transplanted« plaice. Out of the c. 80,000 plaice which were transplanted this year, every 7th was marked with a hole in the dorsal fin, when placed in the Fjord; about every 5th of those which were caught this year had such a hole, which proves that no other plaice live in that expansion of the Fjord. — Possible mistakes in marking them. — On the fishing for the plaice thus marked, and on their *quick* growth and *considerable* size; — only a few of them get time to reach maturity, as they are caught before they have the necessary total length, c. 15—17 inches. — Why the plaice do not grow as large in the other expansions. They leave Nissum-Bredning when they are young, to immigrate into the Fjord towards the east. In Venø-Bugt, on the other hand, they stay; yet they do not reach the same size as in Thisted-Bredning — scarcely because the bottom is not suitable, but there are here many more fish per Tønde Land (56,000 Danish square feet*). — An attempt to count how many fish over the size limit ($9^{3}/_{4}$ inches) they have caught this year in September—December per Tønde Land in Venø-Bugt, Kaas-Bredning, and Lavbjerg-Bredning, by means of daily statistics of the seine and net-fishery here. — It appears from this that 297, 376, and 221, respectively, have been caught per Td. Land, and that the fish over the size limit must be supposed to have been fished up for this winter. Besides the said fish over the size limit a very great number, per Td. Land, under the size limit have been living there. — It is possible that the slower growth of the fish, proved by labelling them with bone buttons, is owing to their greater number per Td. Land. — Local overpopulation. — It must be possible to prove the fishing-up by means of labelling the fish with a number. — On counting the number of plaice in Thisted-Bredning and Nissum-Bredning by seine-fishery. — On the distribution of the fry of plaice in the seas in general and in the Limfjord in particular. — Propositions to augment the profit of the plaice fishery in Thisted-Bredning and Visby-Bredning by the transplantation of fry and by a rational annual fishery. — The government has obligations to support such experiments which cannot be carried out with profit by private individuals unless the fishing-rights are altered. — Propositions for experiments.

Appendix I. The Limfjord and its various parts measured in Tønder Land.
— II. On labelling of living plaice in the Limfjord in 1895.
— III. Daily accounts of the plaice fishery in Venø-Bugt, Kaas-Bredning, and Lavbjerg-Bredning 1. September—31. December 1895.

*) 1 Tønde Land = c. $1^{1}/_{11}$ acre.

When the Biological Station in 1895 arrived at Nykøbing (on the isle of Mors, Jutland) it was one of its principal tasks to study the **biology of the plaice** in the Limfjord. — It must be remembered that this fish is a newcomer in the Fjord, as it was not found there before the breaking through of the German Sea in the beginning of this century, though I shall just mention that a few specimens have certainly lived in the eastern part before that time, just as in our days. The western part of the Limfjord, however, is by far the richest in plaice. West of Logstør the plaice fishery may be calculated at c. 300,000 Kroner a year (comp. the public statistics), while they scarcely fish for more than a few hundred Kroner east of Logstør. To understand this it is sufficient to mention that the waters east of Logstør are much smaller in area than those to the west of this place (see Appendix I) and that only a proportionally small part of them, on account of the depth of the water and the conditions of the bottom, are suitable for the plaice.

I could therefore at once limit my investigations to *the Limfjord west of Logstør*. Here, however, the plaice is not equally distributed everywhere, nay it is almost quite missing in the two large waters south of Hvalpsund, *Skive-Fjord* and *Louns-Bredning with Hjarbæk-Fjord*, although the conditions of the bottom in Louns-Bredning cannot be called unfavourable to them. On the other hand they are found, in greater or smaller quantities, in the other larger waters *Nissum-Bredning, Løvbjerg-Bredning, Venø-Bugt* (i. e. »cove«), *Kaas-Bredning, the waters east and west of Mors*, as also in *Thisted-Bredning* and, finally, in *Liv-Bredning**). They are missing, however, in smaller parts of these waters,

*) *i. e.* the whole large expansion of the Fjord between Salling, Mors, and Himmerland.

either because the conditions of the bottom (where it is overgrown with zostera) do not fit the plaice, or from other reasons; they are rare for instance in the *locked waters* at Nykøbing, at Lemvig, and in Skibsted-Fjord. In *Kilen*, *Hjerk-Nor*, and *Sønder-Lem-Vig* they are almost quite missing.

When I arrived at Nykøbing, towards the end of April, I immediately examined the fishermen's stores of plaice. There were among them *two large specimens of 15½ inches with ripe spawn.* The spawning-season, ordinarily, must be supposed to be over at this time of the year. In the following days, till the 2. of May, all those sizes of plaice were gathered together which my men could catch in the nearest waters between Fuur and Glyngør. For this purpose they used both seines (some with large, others with small meshes) and weels, nay even prawn-catchers, and they fished on deep as well as on quite shallow water. They got 63 plaice between 6½ and 12 inches, and 2 smaller ones of 4¾ and 5 inches (see Table I, column 13). From the knowledge I have of the fishing-power of my seines I must therefore conclude that there were not many plaice where we had fished, and that scarcely any small ones (under 6½ inches) were living there. I called the attention of the fishermen to this latter fact, but though they promised, in the course of the summer to get me some quite small plaice (»as small as a nail«), they only brought me a few of 3½—5 inches in length*). I dare say the fishermen have mistaken small flounders for plaice. *The fry of 1894, therefore, must be said to be almost quite missing in these waters*, i. e. north of Glyngør in Sallingsund, and *the fry of this year (1895) was not found at all.*

No eggs of plaice were found at this time floating in the water; after the above mentioned find of ripe plaice we might have expected still to see at least a few specimens, though the spawning-season at other places generally is much earlier in the year and only exceptionally lasts till the month of May. A number of other pelagic eggs were found, however, of the *flounder* as well as of the *sprat* and *rockling.* Ripe flounders were found in great numbers at this time, but I could not catch any ripe sprats and rocklings, though they certainly live there; I was only prevented from catching them by practical difficulties and want of knowledge of their dwelling-places.

* The smallest which have been observed were caught by myself on the 22. May in a seine at Sæbygaard Hage (nearly off Nykøbing in Sallingsund); I found 7 between 2¼ and 3 inches in length.

We went then northwards in the waters to the shores of Liv-Bredning, but *also there we looked in vain for the little plaice;* at most just a few specimens may be found here. On the 13. May 95 I went towards the south, in the Biological Station's decked boat »The Mackerel«, attempting to seine at Nymølle opposite to Sillerslevør *at the southern end of Sallingsund, and there I found the fry of 1894 in considerable quantities.* It was found by seining on the bars. We took 135 plaice between $2^1/_4$ and 4 inches, one of $4^3/_4$ inches, one of $5^3/_4$, and two of 6 inches; moreover 16 flounders between $2^1/_2$ and $5^1/_4$ inches were caught. By seining farther out in Kaas-Bredning on 3 fathoms of water with soft clay bottom*) we got a number of larger plaice, but none over 10 inches; on the other hand we found also here a few specimens of $2^1/_2$ inches, which ordinarily, are always attached to the clean sand bottom very near the shore.

From this place I went south of Mors to *Aggerø-Dyb* (i. e. »deep«) where the great prawn fishery is carried on at this time. In the »Deep« we caught, on the 14. May, with a seine, in three hauls, 31 plaice between $10^3/_4$ and $6^1/_2$ inches, and by wading we found on the sand altogether only 2 plaice, of respectively $2^1/_4$ and $2^1/_2$ inches in length. I must conclude therefore that but very little fry of the year 1894 is found in these waters west of Mors and north af Jegindø.

On the 16. May the low shallows at the entrance of *Hjerk-Nor,* situated in a fjord east of Nymølle, were investigated, and a great number of flounders were found between 3 inches and $6^3/_4$, but only 9 plaice, all between $2^1/_4$ and $3^1/_4$ inches.

By seining from »The Mackerel« in *Thisted-Bredning,* 20.—21. May, no fry at all was found on the shores, and altogether in a few hauls on deeper water we caught only 11 plaice between 10 and $7^1/_2$ inches. *3 of these were marked with holes,* as we do when marking the plaice which are transplanted into the Fjord.

It may thus be said that *the small plaice of 1894 become rarer the farther we go from Kaas-Bredning towards the north,* that *they are quite missing in Thisted-Bredning, and with very few exceptions in Liv-Bredning too.*

*) This soft, gray clay bottom, so rich in little bivalves of the genera *Solen, Corbula, Abra, Nucula,* etc., without any trace of vegetation, is characteristic of these western expansions of the Fjord, as also of Thisted-Bredning. Such a clean clay bottom is found in no other Danish fjord where I have been, and I am convinced that it is not existing in any of our fjords.

In the beginning of June 1895 we were seining several times from the »*Hauch*«, a gunboat which was then placed at the disposal of the Station. The small plaice between c. 2 and $3^1/_2$ inches were found at several places in Kaas-Bredning, *increasing in number* through *Nissum-Bredning* and farther on to *the entrance of Thyborøn canal. On the shallow sands here we found at length, by wading, the fry of 1895 in great quantities, consequently the fry of the year.* This vas then between $^5/_8$ and 1 inch long. (Table I, column 2).

Lateron, when we were onboard »The Mackerel« on the 18. June, we found again the fry of 1895 (the 0-group) at this place, at the »Canal«; on the 16. September 1895 it was caught again from the »Hauch« in very great quantities, further, on the 3. October, with »The Sea-eagle«, and the 4. December with the sailing cutter »The Tern«. By little and little it had commenced emigrating on deeper water, and in December 95 it had reached a length of $1^3/_4$—3 inches; it was consequently of about the same size as the fry of 1894 in June 1895 (c. 2—$3^1/_2$ inches). (Table I, columns 3—5.)

As the fry of the year grew larger it commenced, as I have said, to go out on deeper water, so that it could be caught in seines from the very ships; it was not necessary any more to wade in the quite shallow water in order to catch them. It also went deeper into the Fjord, so that it could be found in September and October south of Jegind-Tap in Lavbjerg-Bredning (Table I, columns 6—7), nay even, though in smaller quantities, east of Jegindø in the very Kaas-Bredning. (Table I, columns 8—9.)

These investigations into the life of the young plaice in its first year of existence agree exactly with those published in Report V, pp. 43—47, and I cannot see they can be explained in any other way than by saying *that the plaice does not breed in the Limfjord properly so called; but its tender fry,* which in considerable quantities live along the bars of the German Sea, and more particularly at Thyborøn, *is driven by the current, or goes voluntarily, in through the »Canal« and then farther into the Fjord*, growing at the same time larger and larger. From this reason the smallest young plaice can be found in Nissum-Bredning only, those which are a little larger at Jegind-Tap, in Kaas-Bredning, and (very few) in Sallingsund. This is the way the great majority of them goes. A glance at the measurements, table I, shows directly this migration of the fry from west to east, as also that it goes very slowly, as the fry is generally over two years old when it has passed through Sallingsund. — The information contained in this table, the measurements in inches as well as the headings, will give the details of this matter. It is a matter of course that not every young plaice which

has once got within the »Canal« is bound to stay in the Fjord; I suppose it is impossible that not some of them must be carried out again by the outward current. This will be the more difficult, however, the farther they have got into the Fjord. —

Many will object, perhaps, that when the plaice in the Limfjord, as above stated, can develop ripe spawn, and I may add also ripe milt, it must also be able to propagate there. To this I can answer only: Well, perhaps it is able, under certain circumstances, to do so, but the *result of the propagation* (i. e. *the fry*) *is missing*. Till we see this result, I must emphatically maintain that the propagation is of no moment with respect to the preservation of the stock. — To this question I shall return later on.

There are however, as it may be seen from table I, also larger plaice in Nissum-Bredning, than these little young ones. Column 2 shows that we in June 95, besides the 0 and the I-group, took fish from c. 4—9 inches in length. Larger specimens than these are rare in Nissum-Bredning. They are consequently nearly all of them under the size limit. At times certainly, somewhat larger fish may come in from the sea, but that is another thing; it is said particularly to occur in the early spring. It is chiefly the largest specimens of the II-group, between c. 6 and $9^3/_4$ inches, which are transplanted into the expansions of the Fjord north and east of Mors, but they are generally caught in the German Sea, just off the »Canal«, and we know that they reach a length of c. 12—14 inches in the course of summer and autumn (comp. Appendix II) in Thisted-Bredning, while they do not grow so much if they are transplanted for instance into Venø-Bugt. We see in columns 3—5 that the stock within the »Canal« later in the year consists only of a 0-group and a I-group, both of which have grown considerably, but of a proper II-group there is then no trace. As there is actually no fishery here in the summer, this II-group must have left the place. Some, perhaps, have gone out to sea, though this is scarcely the rule, as these fish do not willingly enter too low waters, which they must do in order to pass the shallow banks and go through the narrow and winding »Canal«*); it is necessary therefore to suppose that a very great number of them have gone eastward farther into the Fjord, where towards autumn (partly already in summer) a size-group occurs from (7) 8 to 12 (13) inches, on the largest-sized half of which (10 [$9^3/_4$]—13) the great fishery in Venø-Bugt and Kaas-Bredning is based. (Table I, columns 9, 11—12).

*) When the young fish are so inclined to enter the »Canal«, the reason is just that they want to live on the shallow sand-banks along the shores of Jutland; they go then with the current easily into the »Canal«. Later investigations have shown, however, that rather considerable numbers, in certain years, emigrate again to the German Sea.

Now I do not mean to say that the II-group at a certain time immigrates from Nissum-Bredning to the more eastern parts of the Fjord; this migration takes place I dare say now and then at all times of the year, and moreover we have seen both the I-group and the 0-group take part in such a migration; but it seems at any rate to be the rule, *that the plaice very rarely stays in Nissum-Bredning till it is grown-up,* as it goes farther into the Fjord before this happens. — As above mentioned, the fishery in Venø-Bugt and, upon the whole, south of Mors is based on the II-group, fish of c. 9—12 lbs. the score and $9^3/_4$—12(13) inches in length. *On an average they are never larger here,* not even late in autumn. Only very few are larger, and these have often spawn and milt. In the course of winter the fishery by little and little ceases for want of plaice, i. e. none are caught in the fishing-apparatus — the fish have disappeared. Where they have gone to, we shall learn later on.

If we would now examine the ordinary run of plaice which are caught by the fishermen north and east of Mors, we should find that, at times, particularly in spring, they are also rather small, about the same size as those in Venø-Bugt and Kaas-Bredning; but towards autumn they are considerably larger. With respect to *Liv-Bredning* I cannot give quite satisfactory information of the size-groups. The reason of this is, partly, that it is not so easy to take one's bearings in this expansion of the Fjord with its many stony shallows, which prevent our seining, partly that there are not by far such multitudes of plaice everywhere here as in the more western and southern expansions. The experiments will be repeated in coming years, but it is certain that *the fish they are fishing for here in autumn is considerably larger than the fish in Venø-Bugt* (comp. Table I, column 15) a fact which has long been well-known to the trade, *for it is the same thing every year.* Nor is here any strongly marked III-group to be found. The fishery is here as well as in Venø-Bugt based on the II-group. Mature fish (the III-group) are here rather rare, and are mostly found only among the very largest, those of 15—16 inches in length.

When the statistics shows that the fishermen who live at Sallingsund, Liv-Bredning together with Skive-Fjord and Hjarbæk-Fjord (District B), have an annual income from the plaice fishery of c. 150,000 Kroner, pretty nearly the same as the fishermen who live at the waters north, west, and south of Mors (District A), this is partly because the fishermen who live in District B often fish in District A, but not vice versâ, partly because the plaice in District B, though certainly much smaller in number, by their larger size and the high price they fetch on account of this, give a proportionally great pecuniary profit.

In District A the price generally is*) $1^1/_2$—2—$2^1/_2$ Kroner per fourscore, in District B we often hear of 3—5—7 Kroner a fourscore, and sometimes much higher prices (14 Kroner per fourscore). Such a thing is almost unheard of in the southern and western parts of District A, but not so at Thisted-Bredning and the smaller waters connected with this expansion of the Fjord, west of Mors, particularly Vilsund, of which I shall now give further particulars. —

I was strangely impressed when we for the first time, on the 7. July, onboard the »Hauch«, from Nissum-Bredning and Veno entered these waters and fished with our seines; while at the former places we could get many plaice in every haul, particularly with the seines with small meshes, we got at Visby-Bredning in one haul only a frog-fish in the seine and *no flatfish at all*. East of Gudnæs-Hage, on 10 fathoms, we made another haul *also without catching any plaice*. At Robusk-Odde in the southern part of Vilsund we got however in one haul 3 plaice of respectively $10^3/_4$, $10^3/_4$, and $11^1/_4$ inches in length; the caudal fins and dorsal fins of all three were a little damaged, as if they had been kept in a fishing-smack with well and been hurt while sailing. The fins must then have been healed again later on, for the fish were quite well and comfortable.

A haul in the narrows of Vilsund gave 4 plaice of respectively $9^1/_4$, 10, 10, and 11 inches in length; one of these had a hole in its Dorsal fin (it was consequently marked). — We tried to catch small plaice here in a seine with small meshes, but one haul gave altogether but one plaice of $8^3/_4$ inches; the tip of its caudal fin was worn away. As above mentioned, I never saw the fry properly so called in this water or, on the whole, in Thisted-Bredning.

On the 8. June we made 6 hauls at different places of Thisted-Bredning with a plaice-seine which is 40 fathoms long. We used for that 100 fathoms of line on each arm. The catch of plaice was 18 between $9^1/_2$ and $11^3/_4$ inches, and a larger one of 10 inches whose caudal fin, however, was almost quite worn away Of the 18 plaice 2 were marked with holes in their fins and the fins of many were damaged, as it is generally the case with fish that are kept in fishing-smacks with well or in cauls. On the 21. May I had, from »The Mackerel«, made 2 hauls with a plaice seine in Thisted-Bredning and caught 11 plaice between $7^1/_2$ inches and 10 inches. 3 of them were marked with holes in their fins and several had suffered damages of the above mentioned description.

I could say then with certainty that the stock of plaice in Thisted-

*) I speak here only of the price which the fishermen obtain.

Bredning and Vilsund consists only in plaice over c. 7 inches, as also that there are but very few living there per Tonde Land compared to Nissum-Bredning and Veno-Bugt. Moreover, a proportionally great number of these fish were marked in the fins or in other ways damaged. It very soon struck me that perhaps there were scarcely any other plaice here than those which are annually transplanted from the German Sea, partly by Messrs. *Mehlsen* and *Sørensen-Rønn*, the fishmongers (of Struer), partly by *The Fishermen's Union of Thisted and the Surrounding Country*, both with subsidies from the Government. These transplanted fish are c. 7—10 inches at the time of transplantation, and as they grow quickly, the largest may very well have grown from 10 to 11$^3/_4$ inches; moreover the marks in their fins showed that some of them at least must be identical with the fish placed there in the spring of 1895. — The fishermen had some few very large plaice; these must be supposed to belong to the transplantations of former years, a thought with which the fishermen were quite familar.

The said transplantation commenced in the spring of 1892, on the initiative of Messrs. *Chr. Mikkelsen* and *F. H. Mehlsen*, and has since been repeated every spring. Their idea was: the plaice in the northern and eastern parts of the Limfjord are large, but there are too few of them, consequently some more must be fetched in. In Thisted-Bredning this transplantation *soon resulted in quite considerable advantages;* »the large plaice from Vilsund«, certainly, had long before that time been a well-known dainty, but the transplantation had a considerable influence on their number; formerly they had been very rare, as far as I have been able to learn. — This year, as I am informed, c. 82,580 plaice have been transplanted into Thisted-Bredning, 10,900 of which are marked with a hole in the dorsal fin. 8200 were transplanted into Visby-Bredning, 3000 of which were marked with two holes in the dorsal fin, moreover a number were transplanted into Liv-Bredning, some of which were marked with one hole in the dorsal fin and one in the anal fin; finally, a number were placed in Louns-Bredning and Hvalpsund, some of which were marked with a hole in the anal fin. — These holes are cut very easily and quickly with an iron punch, and leave a scar which is almost always distinct from any accidental damage; the punched rays, particularly, are easily recognisable. The fish were marked by the inspectors, on my initiative and in accordance with my directions. — This way of marking the fish has many advantages; it is quick, cheap, lasting, and does not hurt the fish; but it is not easily perceptible when you do not know the marks and their scars, and *you cannot recognise the single individuals.* It answered my purpose, however, perfectly well,

as I shall now show. In October 1895 I saw 28 plaice in Thisted harbour, 6 of which were marked. In December 1895, when many large plaice were caught at Thisted, a thoroughly reliable man examined 560 of them; 112 of these were marked with one hole in the dorsal fin (the mark of Thisted-Bredning), 4 with two holes in the dorsal fin (the mark of Visby-Bredning), 2 with one hole in the anal fin (the mark of Louns-Bredning), and 1 with one hole in the dorsal fin and one in the anal fin (the mark of Liv-Bredning). Every fifth of them, consequently, was marked with the mark of Thisted-Bredning. Later on in December 95 another man examined 440 at Thisted, and he informs me that 81 were marked with a hole in the dorsal fin, very few had a hole in the anal fin, and a few 2 holes in the dorsal fin; also here then the marked fish are about $^1/_5$ of the whole number.

This result is very strange; for while only, as stated to me, c. $^1/_7$ of the whole number of fish placed there was marked, every fifth of the fish caught there was marked, consequently a proportionally larger number. I shall not here try to decide, if perhaps the explanation is to be found in a greater mortality in some of those shipments of which only a few fish, or none at all, were marked, or if perhaps the fishing in December has been carried on at places where the cargoes of proportionally many marked fish were placed or had migrated to*); at present it is sufficient for me to know that so great a number of the plaice in Thisted-Bredning are marked with holes *that all but the whole stock must be looked upon as »transplanted«*.

I shall not enter further into the question of how the few fish with the marks of Louns-Bredning and Liv-Bredning have got in here; I look upon it as very doubtful whether they have really gone there from the said places. When we know how difficult it is thoroughly to empty a fishing-smack with well, we are rather inclined to suppose that some few have been left in the well from one fishing excursion to the next. When the plaice had been marked they were placed in the well again, before they were transplanted to Thisted-Bredning. The 4 from Visby-Bredning, on the other hand, may easily have emigrated to Thisted-Bredning, but whether they have really done so is another matter.

82,580 plaice, certainly, are a great number, but they do not fill much in Thisted-Bredning, and I have been told, in sober earnest, though *perhaps* with a little exaggeration that there are fishermen on the Limfjord who yearly use as great a number of plaice under the size limit for their pigs; after all, this is but little more than 300 a day during the 9 months of the year. Those people are said to live on the southern and western shores of the Limfjord.

*) The fishing was not limited to a few particular places, but carried on everywhere in the expansion of the Fjord.

I only mention this to show that there are fishermen in certain parts of the Fjord who consider the destruction of little plaice a very little matter, though the fish are badly wanted in other parts, and because it shows that there are huge numbers of plaice in these regions *). We know now, however, that there are none, or next to none, in Thisted-Bredning, except those which are placed there. — When these 80,000 in spring are carried into this expansion of the Fjord, nothing prevents the fishermen from catching them immediately; nobody, however, will perhaps fish for them exclusively at once, but now and then they get them into the eel-seines, and as soon as the fish are over 10 ($9^3/_4$) inches to the tip of the caudal fin they are at any rate not thrown out again, for then — according to law — they may be sold. The largest are 10 inches already at the time of transplantation. — Till September this year (95) c. 50—60,000 of the transplanted plaice are stated to me to have been caught, chiefly in this way, though also by fishing exclusively for them with plaice nets, and sold at an average price of 13 Øre a piece. There were thus only c. 20—30,000 left when the proper fishing-season was to commence. — In spring they are delivered from the sea at c. 2—3 Øre a piece, so that, certainly, their value is considerably increased; but if we examine those that are left at new year's time, we find that they weigh c. 25 lbs. the score, and fetch about 25 Øre the lb., consequently c. 33 Øre a piece, and when sent to Copenhagen they are sold here retail at c. 50 Øre per lb. on account of their size and excellent quality. They have now grown from 6—10 inches in spring to 13—14 inches, and weigh on an average more than 1 lb.

The holes and the other marks (bone buttons) prove that they are indeed the same individuals with which we have to do, and which were 6—10 inches long in spring.

The value of these fish is thus at least 10 times as large as in spring. But there is also another thing: a plaice is, ordinarily, not mature till its 4th year, and these are as yet in their 3rd; nor have I succeeded in finding mature spawners among them, although I have found mature milters, which, consequently, become mature here before the spawners. The few specimens from the transplantation in 1894, which were not caught in the same year, but of which one marked with the number 503 was caught in October 1895, when it was $16^3/_4$ inches long, are generally 16—17 inches long and weigh in good condition between 2 and 3 lbs.; they cost 50—75 Øre a piece. *Among*

*) It may be mentioned here also that masters of fishing-cutters, who have often caught little plaice in the German Sea off Thyborøn, have informed me that they can easily take 50,000 plaice in one day. What takes most time for them, they say, is to count them.

those we find mature females with, at any rate, nearly ripe spawn. It is a pity their number is but slight; indeed it is not every week of the year that such a one is caught, to that degree they have been fished up. *It is such a size the plaice would ordinarily reach in Thisted-Bredning, at any rate the spawners, if they were not fished up before.* The value of these plaice has, by their stay in this expansion of the Fjord in 1—1½ year, become 20 times greater than it was at the time of their transplantation. — It will be observed that, while their growth in length during the first three quarters of the year is considerable, from c. 6—10 to 13—14 inches, it is much less in the next half year (to 16—17 inches), but their weight is augmented to about the double. As there are so few large fish I cannot give exact average-figures. — These plaice are large, to be sure, but in the Cattegat and the German Sea there are those which are as large, nay even larger; in the Cattegat I have seen plaice of 21—22 inches in length, and *E. W. L. Holt* in England has thought it necessary to propose a size limit of 17 inches for plaice in the German Sea, because the spawners do not become mature till they reach that length. Our plaice at Thisted, it must be remembered, hail from the German Sea also, and have by their growth proved that they belong to the large race. No wonder, therefore, that they become so large in Thisted-Bredning; it is much more *astonishing that the plaice do not become as large everywhere in the Limfjord*; this wants as yet some explanation.

As soon as I became acquainted with the *quick growth* and *considerable size* of the plaice in Thisted-Bredning, my first thought was that all plaice in the other expansions of the Fjord grew as large, and that, where the plaice were actually smaller, we had to do only with young fish, which as they grew larger went away to other places where the large plaice usually live, as it is well known from our more open shores. — This, certainly, must be the state of things in Nissum-Bredning; for no plaice lives here for several years, as we, with but very rare exceptions, only see small and hardly ever any mature fish here*). If, therefore, we would preserve the plaice in this expansion of the Fjord in hopes of getting larger fish *here* by this means, we should certainly be disappointed; they go away before they reach maturity, and are replaced by young fry immigrating from the German Sea. This was proved also when Krik-Fjord was locked; this was done 1888, and the plaice here have

*) Two fishermen, or rather occasional fishermen, living at Thyboron Canal, who for years have carried on some fishery for small plaice when their farming left them time for it, simply declared that plaice, upon the whole, never have any spawn as other flat-fishes.

not grown any larger since. The conditions of Nissum-Bredning, however, are such that but a very inconsiderable plaice fishery is carried on there; they fish a little at the »Canal«, and that is nearly all, except in spring in the »immigration time«; the reason is that the plaice are so small that they cannot be sold.

When the plaice go eastward from Nissum-Bredning, they pass through Oddesund to Lavbjerg-Bredning and Venø-Bugt towards the south and Kaas-Bredning towards the north-east. These places also swarm with plaice at certain times; by far the greatest number of those which are caught in the Limfjord are caught in these waters, particularly in Venø-Bugt and Kaas-Bredning.

The plaice is here generally much larger than in Nissum-Bredning, but smaller than in Liv-Bredning; I have mentioned this already above (see Table I) as also that the fishery here is based on the II-group. When the plaice does not reach the same size here in its third year (the II-group) as it does in its third year in Liv-Bredning and, particularly, in Thisted Bredning, the reason cannot be that it emigrates as it grows larger (as it is the case in Nissum-Bredning); *the reason is*, as it has been proved this year by labelling the fish with numbered bone buttons, *that it does not grow so quickly here as it does in Thisted-Bredning*. (See Appendix II.) I cannot know with certainty, if it would indeed reach the same *size* as its brothers and sisters in Thisted-Bredning, if it got time for it before it was caught, but there are indications to show that it becomes mature at Venø with a somewhat smaller average length than 16—17 inches, so that it would scarcely, as a rule, become as large as in Thisted-Bredning, even if it got old enough. For want of a sufficient number of fish of the III-group, I cannot state the average size of this group at Venø, but so much is certain, that the mature spawners I have seen there are to be found among the larger fish there, of for instance $12^{3}/_{4}$ inches, and the milters are 11—12 inches; almost all the smaller fish, on which the fishery is chiefly based, are not mature, consequently not large or old enough to be so. There are certainly caught fish of 15—16 inches in this water; but as I have said, they will scarcely reach the same average size as in Thisted-Bredning (17 inches), even though they become old enough; in this respect, as well as by their slower growth, they are distinguished from the plaice in Thisted-Bredning. It will be perceived that it is always the III-group that is scarce, the grown-up mature fish. — It lies near to ask now, why a plaice which is removed from Venø-Bugt to Thisted-Bredning, grows quicker and becomes larger here, than it would have done, if it had remained in Venø-Bugt (see Appendix II: On labelling of plaice), and the fishermen's

answer to this question is »that the »bottom« suits the plaice better in the former water than in the latter«. The fishermen, however, have scarcely taken the trouble to examine what it is that forms the food of the plaice, or how the condition of the bottom really is, i. e. to examine its wealth of food suitable for plaice; but according to what I have seen as yet I must say that the bottoms of both waters are particularly suitable for plaice. I must look somewhere else, therefore, to find the reason of their unequal growth, and it seems to me that nothing lies nearer than to look for it in *the different number of plaice that lives per Tønde Land* in these two waters.

We have seen that, at any rate this year (1895), there were no other plaice in Thisted-Bredning than those 82,580 which had been placed there in the spring 1895. When we suppose them equally distributed over the whole of that part of the expansion of the Fjord where plaice use to live (i. e. from 3 fathoms' depth and outward) this gives only ca. 7 per Tønde Land. In those expansions where the plaice is small, Venø Bugt and the expansions at Kaas, Lavbjerg, and Nissum, there are many more per Tønde Land. This is a fact known by everybody who has been fishing there; but I shall try to give a little closer information of it, because I should like also to show that it *is possible* in these matters to work in a somewhat more exact way than people generally do.

We can in various ways *approximately calculate the number of fish in these waters*, a thing which, as far as I know, has never been attempted in the sea, except by *Hensen,* who tried to make out the number of grown-up plaice in the western parts of the Baltic Sea, by counting all the eggs of plaice floating there in the spawning-time. When the number of these was divided by the figure which, according to his countings, must be supposed to represent the average number of eggs of grown-up plaice, he thought to get a figure that showed the number of the grown-up female plaice. I shall not here, however, enter further into a discussion of this very interesting experiment, and the range of its results, much the more so, as this method cannot possibly be employed in the Limfjord; there are no eggs of plaice, or scarcely any, in the water at any time of the year, as the plaice does not breed there, or at any rate does so but very rarely. — My method will be understood from the following.

According to the present regulation the plaice-seine fishery in the Limfjord commences on the 1. September. From that day, when the weather did not prevent them and it was not at holiday, the fishermen this year used daily c. 60 plaice-seines in Veno-Bugt, and c. 90 in Kaas-Bredning, besides a great number of nets. The result of the daily fishery in these two expansions of the Fjord, as also of that in Lavbjerg-Bredning from 7. October, is

given in Appendix III. We learn that a few days went by (2.—7. September) before they found the best fishing-grounds in **Venø-Bugt**, which gave 36—44 score per seine a day. *This lasted only for 12 fishing-days.* Then they came down to 20 score per seine a day, and from this time the catch, both by seines and nets, decreased constantly, *though the number of seines at the same time was diminished. With the end of November the fishery had almost ceased*, consequently after the elapse of 3 months.

In **Kaas-Bredning** they found the plaice almost immediately, and *after 13 fishing-days the catch*, both by seines and nets, *was perceptibly decreasing.* In November only 30 seines were fishing in this expansion; 90 had been fishing there in September. *This fishery may be said also to be nearly over at the beginning of December.* The fish caught at both these places weighed from c. 11—12 lbs. the score, and the price was from $1^1/_2$—3 Kroner per fourscore, on an average consequently not quite 3 Ore a piece.

In **Lavbjerg-Bredning** the fishery did not commence till 7. October; here we find also a considerable *decrease in the fishery from boats, after some ten days, and this decrease occurs at another time than in the two other expansions, viz. in October, though also here a short time after the beginning of the fishery.* When the fishery commenced so late in Lavbjerg-Bredning, the reason was that there is at this time not much more to be done at the two other places, so they prefer to go up here in their boats where the fishis, certainly, still smaller than in the two other expansions of the Fjord, but where they can take now as many as 40 score a day. The fish weighed here, this year, only $8^1/_2$—9 lbs. the score, and the price was towards the end of the season $1^1/_2$—$2^3/_4$ Kroner per fourscore, on an average only c. $2^1/_2$ Ore a piece, just what the plaice under the size limit, which in spring are transplanted from the sea into Thisted-Bredning, cost the state.

Altogether there are in 4 months caught c. 2,365,640 plaice in *Venø-Bugt*, which gives 297 per Tønde Land of the area within the 3-fathom curve.

In *Kaas-Bredning* there are in 4 months caught altogether 2,543,240 plaice, which gives 376 per Tønde Land of the area within the 3-fathom curve.

In *Lavbjerg-Bredning* there are in 3 months caught altogether 643,400 plaice, which gives 221 per Tønde Land of the area within the 3-fathom curve.

As will be seen from the statistics (Appendix III), by far the greater number have been caught in September, in Venø Bugt as well as in Kaas-Bredning, but there can be no doubt that also the fish which were caught after that time were living in these waters in the month of September, *which, consequently per Tønde Land must have had at least, at the very least, respectively 297 and 376*

plaice over 10 inches, or 43 and 56 times more than there were per Tønde Land in Thisted-Bredning; nay, there have certainly in spring been even many more per Tønde Land in these two expansions of the Fjord, not counting the fish under the size limit, for there has through the whole summer without any interruption been carried on a considerable net-fishery, which was constantly increasing towards the month of September. It was only the seines that could clear out the fish, partly on account of their powerful fishing-capacity, partly owing to their great number in these proportionally small seas. I have not tried to calculate how many times the plaice-seines in the course of September are dragged over every spot of the bottom of these smooth seas, which are so particularly fitted for seine-fishery, but it is often. Can anybody wonder that the III-group is rare in these parts?

My view on this matter is, briefly, that young fish of the I-group, and partly also of the II-group, at various times of the year enter into these seas, particularly in the course of winter and spring; they grow up and must, after the month of March, be considered a II-group, partly a III-group (as March is supposed to be the birth-month of most plaice). Particularly in the course of the summer they grow quickly, and a net-fishery is immediately carried on in order to catch them. When the seine-fishery commences in September, all fish over the size limit are fished up in a short time, and there will be no fishery again till a new generation has immigrated again and has grown up. — Only a smaller number of fish run through these seas and Salling-Sund as far as Liv-Bredning; here they grow somewhat quicker, and they know better to hide away and disperse in the large expansion, so that a more intense fishery will not pay here on account of the smaller number per Tønde Land, before they grow larger and more valuable. Partly from this reason, and partly because they grow more quickly, they become a little larger here than at Venø and Kaas. *In these seas then nature herself carries out an annual transplantation on a large scale, similar to that which man carries on in Thisted-Bredning on a much smaller scale: but at both places the stock of fish over $9^3/_4$ inches (over the size limit) is fished up every year.*

When discussing this question with various men, I have often been asked, whether it is not remarkable indeed that the plaice does not of its own accord go into Thisted-Bredning, when the conditions there are so well adapted for it. The answer to this question is 1) that the plaice on the whole seems to migrate slowly, 2) that a few specimens after all go in there, but that these are very soon fished up, *e. g.* by the eel-seines, 3) that there are great hindrances for such a migration, both north and west of Mors, particularly the narrow, long,

and winding waters there. At certain places, moreover, the plaice must actually make its way over or through dense »grass-fields« (zostera), where it comes but rarely, and where it has no reason at all to go, as it does not know that there is plenty of food for it farther up. It must be remembered also, that *the plaice is a bottom-fish*, if any fish is so. It is evidently very rarely that it rises from the bottom, even but a few feet, and this happens certainly only for a few short moments; on the bottom, however, it feels at home. These, no doubt, are the reasons why the plaice does not actually enter Thisted-Bredning in greater numbers, and, as far as we know, never has done so.

This detailed statistics tells us that at least c. 300 plaice over the marketable size have lived this year per Tønde Land in Kaas-Bredning and Venø-Bugt. I can add that besides these there have lived rather a considerable number of plaice under the size limit, nay as many perhaps, or even more. By seining the 11. & 14. September and 3. October (see Table I) a very great number of fish under the size limit were found, both in Venø-Bugt and, particularly, in Kaas-Bredning and Lavbjerg-Bredning.

I shall later on, in another way, prove that there lives even a greater number of plaice per Tønde Land in *Nissum-Bredning* than in these waters. It will be impossible to use any statistics with respect to the latter expansion of the Fjord, among other reasons because they fish so little here during these months that the statistics would show nothing at all. It is quite likely, I think, *that the slower growth of the plaice, and the somewhat smaller size which upon the whole it may be supposed to reach in these seas, is thus owing to a too numerous population.* Whether this overpopulation is owing to nature only, or is the direct result of the eager fishing that takes away all the larger fish, which are then replaced by little ones, is not known for quite certain; but in Nissum-Bredning this circumstance is certainly not owing to too much fishing, for, as I have just observed, they fish very little here.

That the plaice in these densely populated expansions of the Fjord really prevent each other from growing, and therefore grow more slowly than in the less densely populated expansions, was proved this year by catching c. 400 plaice, partly at Thyborøn partly in Venø-Bugt, and after labelling them with numbered bone buttons place them in the water again, 200 in Venø-Bugt and 164 in Thisted-Bredning. The latter grew quicker than the former (see Appendix II). As we do not know (as yet at any rate) that the »bottom« at one place is much better than it is at the other, I must suppose that

the different growth is owing to the different number of fish per Tønde Land.

From Veno-Bugt as well as from Thisted-Bredning they sent to me in the course of the year the labels (bone buttons) of about one fifth of the whole number of labels placed there, viz. 44 and 31 respectively; there were in all placed 200 and 164 in the water, the fish being labelled by Mr. *Th. Mortensen*, M. A. In the spring 1894 298 labelled plaice were placed in Thisted-Bredning, and in the course of the year 77 labels came in, consequently about one fourth of them all. This time the fish were labelled by the *controlling officers*, wo were particularly skilful in this work as they had done so several times before — from this reason probably the greater number of labels sent in *). When only $^1/_5$ of the labels are sent in the reason certainly is that the fishermen scarcely send in all those which they get, as they often do not see the labels at all, which are often torn off in the fishing-apparatus, and more particularly *that the labels generally fall off the fish after the lapse of some months*. This year the fishermen had been requested not to keep the labelled fish they might catch before the 1. July, and the labelling took place in April. It will be seen (Appendix II) that July and August show by far the greater number of labels sent in, though the fishery is not very considerable till September. This was the case also in 1894 and 1893. I must suppose therefore that most of the labels fall off before September. Fish with scars from the labels are seen also pretty often in Thisted-Bredning. That nevertheless so great a number of labels are sent in seems to me to indicate that the fishery is carried on very eagerly in these parts. If a labelling-experiment was undertaken in the commencement of September, we should have a better opportunity of seeing how intense the fishery is, for when we spread the labelled fish over the whole fishing-ground, we may with some reason suppose that, proportionally, as many of the unlabelled fish which are living there will be caught as of those that are labelled.

It has been shown above how we, by means of the statistics, can learn, approximately, *how many fish over the size limit there live, at the very least, per Tønde Land* in the various expansions of the Fjord at Veno and at Kaas. This method, however, could not be used in *Nissum-Bredning*, as so very few plaice are fished here, particularly in the summer and autumn. I have here used *another method* to get some knowledge of the number of fish which lived here per Tønde Land, and I got the idea of using it, while carrying on

*) In 1894 there came in also c. $^1/_4$ of the 298 labelled plaice which had been placed in Thisted-Bredning.

some experiments this year (1895) in Thisted-Bredning, onboard the »Hauch«. During my own experiments at Thisted, in the month of May, the idea struck me that the stock there almost exclusively consisted of the c. 82,000 fish that had been transplanted to this place this year, and I must take it for granted, consequently, that, on an average, only c. 7 individuals were living there per Tønde Land in the spring, and now there were not so many, as not a few of them had been caught in the course of the summer. When the »Hauch« later on was placed at my disposal, I continued these countings, for which we used a plaice-seine, 240 feet long from the end of one arm to that of the other; there was a line of 1800 feet on either arm. The fishing was carried on as follows: The »Hauch« anchored on the fishing ground; a jolly-boat rowed nearly straight out with one of the 1800 feet long lines; then it turned 90° and placed the seine (240 feet) in the water *nearly* straight out; this done, the jolly-boat again turns 90° and rows the other 1800 feet long line onboard the »Hauch«. The seine and the lines sink to the bottom, and the whole apparatus (with the lines) describes, consequently, on the bottom of the sea, a triangle with two long sides, 1800 feet long, and a short one (the seine) of 240 feet. When now the two long lines are heaved onboard by means of the steam-capstan, the seine follows along the bottom, but can catch only the fish that lie on the bottom within the said triangle: those which are caught must, we know, have been within the triangle, but, certainly, there have been still more, only they have not been caught. The number of the latter we do not know. The area of the above-mentioned triangle is a little under 4 Tønder Land, but the seine does not by far fish through the whole of this area; for when about one half of the lines is hauled onboard, both arms of the seine have usually got quite together, so that no more fish can get into the seine. The area which has really been fished through may at most be estimated at nearly 2 Tønder Land. If we use only 100 fathoms of line on either arm, the area will be $^1/_3$ of this or c. $^2/_3$ Tønde Land. In Thisted-Bredning and Vilsund, on the 7. and 8. of June, 1895, 8 hauls were made with 100 fathoms of line, at 7 various stations. About 25 plaice were caught, or scarcely 5 per Tønde Land. Of these 25 3 were marked with holes and several were damaged. The 17. September we made three hauls, each of 2 Tønder Land, and the catch was 16 plaice, 2 of which were marked with holes and several damaged. That gave, consequently, $2^2/_3$ plaice per Tønde Land. We calculated 7 per Tønde Land in spring, and as we know that a considerable number has been fished by and by, the results of these experiments to some degree confirm the calculations. It was these experiments that gave me the idea that such countings by means of seine-fishery

might be possible in seas where the bottom is smooth and upon the whole fit for seining in all parts.

Just such a sea we have in Nissum-Bredning, and on the 3. and 6. of October we tried to count the plaice there. As the fish are small here I must use a seine with very small meshes — nearly like those of a common unlawful eel-handseine. I knew from former occasions how excellently fitted for plaice-fishing this seine is, and every fisherman knows that there is a very great difference in the fishing-power of the seines. This seine was only 90 feet long and had 100 fathoms of line on either arm (on »the long arm« of course also a spare line). By the same calculation as before, the area which was fished through in each haul may be estimated at $^1/_4$ Tønde Land.

The fishing commenced within Thyboron, and by and by 8 places were searched, distributed over the whole expansion of the Fjord from Thyboron to Oddesund. The first station gave in 2 hauls 218 plaice, consequently:

Station	I	109 plaice	in 1 haul	per $^1/_4$ Tønde Land.
—	II	288	—	—
—	III	208	—	—
—	IV	270	—	—
—	V	334	—	—
—	VI	157	—	—
—	VII	353	—	—
—	VIII	147	—	—

All the stations are situated on a depth of about 3—$3^1/_2$ fathoms, and it will be seen that there is at any rate some meaning in the figures. On an average we caught 233 plaice in each haul, or 932 per Tønde Land, and there have surely been many more; how many we do not know. Of all these c. 2000 fish 39 only reached the size limit; c. 310 must be classed among the 0-group, the remainder among the I-group, which thus contains by far the greatest number. The 0-group is generally found on shallower places than those where we were fishing, and the II-group has immigrated into the more eastern parts of the Fjord. Of the I-group (taken separately) we found by these investigations c. 760 per Tønde Land. — As the area which in Nissum-Bredning lies within the 3-fathom curve, is about 19,000 Tønder Land, there must in those days have lived *at the very least* 19,000 . 760 plaice of the I-group in this single expansion of the Fjord, i. e. 14,440,000, — c. 170 times as many as we annually transplant into Thisted-Bredning, and more than we fish annually in the whole Limfjord, the income from the plaice-fishery here being calculated

at 300,000 Kroner a year, at an average price of 2 Kroner per four-score, which gives only 12 million plaice.

These two methods of investigation: 1) the statistical and 2) that by means of seining, have thus shown us that there are in Nissum-Bredning *at least* c. 932 plaice per Tønde Land, in Kaas-Bredning at least 375, in Venø-Bugt at least 297, and in Thisted-Bredning *at most* 7. I mean that these figures, though they are but approximately correct (except the last of them) afford firmer holds than we use to have when we discuss questions of fishery, and by future investigations they can presumably become more correct. It is a pity that these experiments require matériel (a steam-capstan) which but rarely is at the disposal of the Station.

It is a long-established fact that the small plaice generally live in other parts of the seas than the larger ones. Every plaice-fisher knows this well enough. It holds good in the Cattegat, it holds good in the German Sea, and no doubt it will do so at all places where a genuine stock of plaice is living. The later biological investigations, abroad as well as at home, have now proved that this phenomenon is *not*, as a rule, owing to different average sizes of the various races of plaice, but to the fact that the young and *from this reason* small fish live apart from the older and therefore larger ones. This also explains the fact, which has long been known to our fishermen, that the plaice in certain parts of the Cattegat »never have any spawn and milt«, for they are young fish, while in other parts they have them fully developed, viz. where the grown-up fish live. In Aalbæksbugt near the Skaw spawners are very rare, while they are quite common in the deep eastern parts of the Cattegat, for instance at Anholt, nay, at times we find here only large mature fish. The quite tender fry of one inch or still smaller, on the other hand, are but rarely seen by the fishermen, but their dwelling-place is, as numerous investigations have proved, the quite shallow, protected sands along the shore, where, in early spring, the sun can give the water an exceptionally high temperature. From this fact already we can conclude that the plaice in the course of its life must go from the places near land where it stays when it is young to deeper and deeper water, at the same time as it is growing larger and larger. This migration can, under certain circumstances, be easily seen, and the correct knowledge of it is of great moment with respect to the Limfjord.

The tender fry of the plaice, the fry of this year as well as that of the

preceding year (the 0-group and the I-group), is not equally distributed along all our shores. It is rather scarce on the shores of Fumen, more numerous perhaps north of Sealand, *very numerous* on the contrary on the northern shores of the Cattegat as also at several places on the western shores of Jutland, for instance at Esbjerg and Thyboron, and no doubt it is the currents (indirectly, consequently, the wind) and the salinity (the specific gravity) of the German Sea and the Cattegat which first of all decide to which shores the floating eggs and the tender fry will be carried. The result is at any rate that the fry gathers together at certain places and is not at all equally distributed in the waters. Every German Sea plaice must pass its earliest infancy on the shore, and the direction of the currents as well as of the wind is such, that both have a tendency to carry the eggs and young that float about towards the east, among other places to *the western shores of Jutland, which are, no doubt, by far the most important rearing-place of the stock of the German Sea.* When a cutter, fishing for fry for transplantation into the Limfjord, does not get at least c. 4000 young plaice in every haul with the seine, he is dissatisfied and goes elsewhere, he says, and yet he fishes only the fish of the II-group, consequently proportionally large fish somewhat under the size limit.

It is a shoal of these immense quantities of fry on our western shores that, assisted by the current, is carried through the Thyboron canal and farther into the Limfjord. It will be understood that this fry, which must be estimated at many millions of fish every year, easily will find the room in this closed Fjord too narrow, so that they cannot grow as quickly as in a larger water, where there is a larger area for each fish to live upon, particularly as they meet difficulties in going into some of the expansions of the Fjord. We have seen that while there live at *least* c. 1000 per Tønde Land in Nissum-Bredning, there are other expansions of the Fjord where the plaice would thrive very well indeed, which are almost quite destitute of fish. As long as so many fish live in Nissum-Bredning, we can scarcely expect to produce large fish there in a number worth mentioning; if on the other hand there were only $^1/_{10}$ of the whole number, they would probably all grow quickly. The great number evidently prevents the production of salable fish in this expansion of the Fjord. We know also from other places that too dense a population checks the growth, from ponds in which we have placed too many fish as well as from gardens or forests where we have not thinned sufficiently. The fish, evidently, do not go up the Fjord quickly enough to prevent the injurious results of local overpopulation. — In the expansions of the Fjord east of Nissum-Bredning, Lavbjerg, Kaas, and Veno-Bugt, the number per Tønde Land is exceedingly dimin-

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ished, and here the fish reaches such a size that it is just salable with a slight profit; but not at this place neither is the thinning so considerable as we might desire. The eager fishing, we must remember, is not sufficient; that takes only the largest fish, and the smaller ones are left alone. If we go farther up the Fjord to Liv-Bredning, there do not live by far so many fish here, all-in-all, as there could live, even though we wished to get large fish only, and the fry, properly speaking, is here quite missing.

Only about half of the area of the Limfjord that is suitable for plaice can be said therefore to be inhabited by this fish; the other half is almost quite destitute of it. Moreover, where the plaice occurs there is an overpopulation so that none of these areas give the pecuniary profit they ought to give.

How can these unfortunate conditions be altered?

Under the present circumstances man has done nothing to prevent the migration of the little plaice from Nissum-Bredning to Liv-Bredning and yet it lasts for years; for in spite of their slow *) growth the fish are several inches before they enter the latter, and those expansions of the Fjord which are farther off they would certainly only be able to enter at a considerably more advanced age — but as a rule they are fished before they reach so far. If we would prevent the fishermen from taking the plaice till they get in there, it would certainly be necessary to forbid them to take fish under a very considerable size, and large parts of the Fjord would then be densely populated with *a great number of slowly growing fish*, as the immigration from the sea presumably would go on constantly and produce an overpopulation. The fishing in Veno-Bugt, Kaas-Bredning, and Lavbjerg-Bredning would then most likely be very poor, as these places would come under the same conditions as Nissum-Bredning at present, i. e. they would scarcely produce anything but fish under the size limit; the latter, as we have seen, was to be fixed somewhat higher, and in some of the expansions of the Fjord, such as Thisted-Bredning and Visby-Bredning, there would, even under these conditions, be exceedingly few fish. This is what I fancy would be the result of too much preservation in the Limfjord. — It is just possible that we in this way could make the plaice breed in the inner expansions of the Fjord. This cannot be done now, as there are no full-grown fish, but perhaps the plaice on account of the natural conditions, cannot breed there at all. If it could, we should be able to get fry in the inner expansions in this way.

It is not unlikely, however, that this experiment would give quite other

*) Slow compared to the growth of birds and mammals.

and unexpected results, and it is scarcely advisable, at present at any rate, to try it; but there is another way by which it is possible to change the little bivalves that live in the inner expansions of the Fjord into flesh of plaice, and thus get a profit which is now lost, viz. by fishing some of the small, superfluous plaice in the outer expansions and in a fishing-smack with a well sail them into the inner expansions where they might then be distributed in suitable numbers per Tonde Land. By so doing we should benefit also the expansions of the Fjord that suffer from overpopulation of little fish. A similar transplantation from the German Sea and Nissum-Bredning has already been attempted, as we have seen, on a smaller scale, for instance at Thisted-Bredning and Nissum-Bredning, with the result that the fish thrive well and give the fishermen a good profit. The experiment must be made with a far greater number of fish than hitherto, and a particular law must be passed for fishing in the waters where these experiments are carried out. The latter is necessary in order to get the proper pecuniary profit; for the fishermen might, for instance, begin to catch the fish the very day the transplantation was commenced, as it is done a present.

Young plaice caught in the German Sea can be delivered at Thyborøn Canal in exceedingly great numbers: I am told 50,000 pieces per fishing-day by one cutter. From this place it might be towed in suitable corves into Thisted-Bredning by a steam-tug; the distance is 40 English miles in a smooth sea. — The cost of the experiment depends very much on the weather, as the expenses consist only in hire of a cutter and a steam-tug, and the building of some corves. With favourable weather a few weeks will surely suffice to make the first experiments of transplantation.

The aim of these experiments, more particularly, ought to be *a greater income from the fishery in Thisted-Bredning*, but at the same time we should try to find out *how many plaice we can transplant with profit*. There must be some limits, of course, to the quantity of plaice which a certain water can produce every year. It will be of interest, from a pecuniary point of view, to know this limit for the sake of the very transplantation. The limit will be reached when so great a number of fish are transplanted that they check one another in their growth.

If by this experiment we produced a mature stock of plaice which survived a spawning-season, we should see *whether the plaice upon the whole can breed here*. But even if it can, it will certainly be *more profitable not to suffer it to do so, on the contrary, we should constantly undertake new transplantations every spring;* in this way the fish of one year only will feed on the food which is

suitable for plaice in this water; but if it breeds in there, we shall also feed the fish of the two preceding years. This diminishes the productivity somewhat, and certainly much more than the transplantation will cost; moreover, it would be necessary then to suffer a number of plaice to grow up to a larger size than 1 lb., which at present, no doubt, it is the most profitable to produce, and, finally, we could not then regulate the number of plaice in this expansion of the Fjord. The number might now be too small, now too large, and in the latter case the result would be a production of many, but small and cheap plaice.

The size that gives the greatest pecuniary profit depends on the current prices. If a plaice of 1 lb. fetches the highest price which on the whole is paid for this meat, I shall propose to begin with a yearly transplantation, so that the fish are carried in there in spring and fished up in the course of the same autumn and winter. They have then reached a weight of c. 1 lb. and a length of c. 13—14 inches to the tip of the tail. At present the few fish that are transplanted grow so quickly that this can be done. *How many fish there can grow up so quickly every year* is a question to which the experiment must give the answer.

I shall not at all here enter into calculations of how much Thisted-Bredning may be able to produce in this way every year, but I should think, if we want to produce plaice of 1 lb. a piece, that we may try, at first, to place 50 on each Tønde Land. If then these could grow as quickly as the present 7 per Tønde Land, and consequently weigh 1 lb. in the autumn, everybody can judge for himself what these c. 550,000 transplanted fish will be worth in the autumn. The mortality will scarcely be great in this short time.

It might be thought perhaps that such a production would impair other fisheries in this expansion of the Fjord. Of more considerable ones there are the eel and the cod-fisheries; but in other expansions of the Limfjord, for instance at Venø, these thrive pretty well together with great plaice-fisheries, so that I cannot think there is any serious cause for fear. — Finally, it might be said that this transplantation is no real advantage to our stock of fish, for it only takes from one water (The German Sea) and gives to another. I think this objection is sufficiently refuted by my preceding remarks on the local overpopulation which may be supposed to exist in several of our waters.

Before I have had further opportunities to examine, whether these conditions of the western parts of the Limfjord can be explained only by a supposition of a local overpopulation of plaice, I dare not advise to make arrangements here to counteract overpopulation, but shall pro temp. only recommend experiments with transplantation of plaice from the German Sea.

Before this question of overpopulation is further elucidated, it will be no easy matter to regulate the plaice-fishery in the western parts of the Limfjord in the best way. The size limit that is suitable for Thisted will probably be too high here. One thing, however, seems to be advisable: to commence the fishing with plaice-seines as late in the year as possible, for instance on the 1. November, in order to give the fish as much time as possible to grow, if we will not quite do away with this apparatus; now the plaice are fished up already in the first half of September.

The following is the first paragraph of the instructions given by the Home Department to the Director of the Biological Station: »The object of the Biological Station is to acquire knowledge of all such matters within the science of nature as may be of moment for the development of practical fishery and serve to elucidate questions concerning our fishery-legislation«.

It must be supposed that the above will be of great moment to the practical fishery, particularly in Thisted-Bredning, but we must suppose also that transplantation of plaice into Visby-Bredning, Liv-Bredning, and Louns-Bredning, when carried out on a sufficiently large scale, will have a similar influence. — I shall not here enter further into the question, whether there is any probability of succeeding by this means elsewhere in our seas. It lies near to think of the Issefjord, for instance, or the Sound between Elsinore and Saltholm, the waters north of the isle of Funen with Middelfart-Sund, Kalovig, and similar seas. In enclosed fjords, overgrown with zostera, such as Mariager, we cannot expect any good results of transplantation, as proved by a small experiment in 1894; the plaice does not thrive well there. If there are *few but large* plaice in a certain water, a good result may be expected; in that case the transplanted plaice most likely will thrive and add considerably to the number. *)

*) It is quite probable that successful results may be obtained by a similar transplantation of young fish *into our larger waters*, for instance the Cattegat. The object here must be to distribute the fry artificially over the whole area that is suitable for the growth of plaice. It seems as if the fry is only spread proportionally slow by migration, so that large tracts probably are overpeopled with young fish, while

The next question is now, who is to carry out such a transplantation: the Government or private people? If the fishery belonged to one man, or if on the whole either any private man or any community owned such a fishery, the parties concerned of course might undertake the transplantation or leave it alone, as they pleased; but as the fishery, as a rule, in all our fjords is open to every Danish fisherman, we cannot expect to get very far in this matter by private means. It must be supposed therefore that the Government is indeed under an obligation to our fishery in this respect, and that at any rate the first experiments certainly ought to be carried out by the Government. Further, it would be a decided advantage if these experiments were made according to a *fixed plan,* so that we by and by acquired some experience as to the best way of carrying them out in all details. The seas selected for them, as well as the number of fish that were transplanted, their growth, etc., will have a great influence on the result of the experiments, and it would be a good thing therefore if the Biological Station were always closely connected with them, nay, at first at any rate, conducted them and carried them out. — At present, however, the Station is not at all prepared to undertake such a task.

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other regions are nearly destitute of fish, though they are rich in food suitable for plaice. When I say that I think, for instance, of removing fry from the Aalbæksbugt to the deeper parts of the northern Cattegat, where the large but few plaice are living, every cutter-fisherman will understand what I mean. At present, however, it is quite impossible for me to enter more closely into these questions with respect to our more open waters, as no investigations have been made here from this point of view.

As I have said in an earlier report, it is scarcely the number of the young fish in the Cattegat that is too small, it is the fish that is caught which is too small. To remedy this defect I proposed prohibitions against the landing of fish under c. 12 inches; I think we should get still greater and earlier results from this size limit, by means of an artificial transplantation (spreading) of the fry. Both work in the same direction, viz. towards an annual production of the greatest possible number of *valuable* plaice. — I consider it quite probable that the Cattegat, with respect to plaice-fishery, can be managed almost like a large fish-pond, in which we annually fish up nearly everything that is of any value; I should think that this fishing-up really takes place every year already now. The endeavours of man to get the greatest possible profit are still far behind, however, in other respects analogous to pond-culture.

I shall expressly mention that I have no statistics by which to prove what I have set forth here with respect to the Cattegat; no doubt, however, it would not be impossible to get such statistics, if the necessary matériel were at hand.

Whether it is possible to transplant other salt-water fishes, *turbots, brills, eels, soles, etc.*, into our fjords with profit, is a question which I shall not discuss here.

Copenhagen. March. 1896.

Proposition

for

Experiments with Transplantation of Plaice

from

The German Sea to Thisted-Bredning and Vilsund.

1. A Bill should be prepared with a view to preserving the plaice and managing the plaice-trade in Thisted-Bredning and Vilsund in such a way that we might expect thereby to derive the greatest possible profit from the transplantation. — Only the local fishermen should be entitled to fish for plaice in the said waters. —
2. When the Bill has become a Law the matériel and the money necessary for the annual transplantation should be placed at the disposal of the Biological Station. The transplantation should then be carried out by the Station according to a fixed plan. —
3. Experiments with transplantation of plaice into the said waters should be carried out for 5 years after the Bill was passed. After that time these matters should be managed in accordance with the experience we had got. —

When it is proposed, already while the transplantation is carried out by the Government, that only the local fishermen should be entitled to fish for the plaice, the reason is that, otherwise, they would in all probability be fished up in too short a time, as also that the local fishermen all the year round are subject to the regulations, while outsiders are subject to them only as long as they themselves choose to fish in these waters, which of course will chiefly be at the time when the regulations for preserving the fish are partly out of force, viz. in autumn when the plaice are to be fished up. *)

* It is interesting to see that a special *Regulation for the Coregonus pound-net fishery in the Tømmerby, Mellem, and Osterild Fjords, together with Hoxer-Havn,* prepared by the Amtmand of Thisted at that time *Faye*, was given by a Royal decree of 1811. The coregonus fishery has afterwards, for many reasons, ceased in these waters (on account of embankments and the breaking through of the sea, etc.); but there is thus in a way a precedent for a very special fishery legislation or regulation in the waters of Thisted Amt.

Appendix I.

The Limfjord and its various divisions measured in Tønder Land.

In order to give some information of the extent of the Limfjord and its various divisions, I shall here state the following planimetric measurements, which have been ascertained by Mr. *C. C. Jensen*, assistant engineer of the Danish Royal Navy, who has computed the area at the daily height of water as well as the areas circumscribed by the 1 and 3 fathom curves. — The measurements are based on the latest admiralty charts of the Limfjord, on the scale of 1 : 130,000.

1.	The area of *Nissum-Bredning* at the daily height of water is	45,612	Tdr. Land.
	— — - — beyond the 1 fathom curve is	35,825	—
	— — - — — 3 — is	19,119	—
2.	— — - *Lovbjerg-Bredning* together with *Veno-Sund* at the daily height of water is	10,044	
	— — - — beyond the 3 fathom curve is	2,906	—
3.	— — - *Veno-Bugt* at the daily height of water is . . .	16,400	—
	— - — beyond the 3 fathom curve is	7,968	—
4.	— — - *Kaas-Bredning* at the daily height of water is .	9,441	—
	— - — beyond the 3 fathom curve is .	6,762	—
5.	— — - *Thisted-Bredning* at the daily height of water is	17,488	—
	. - — beyond the 3 fathom curve is	11,843	—
6.	— — - *Visby-Bredning* and *Vilsund* at the daily height of water is	11,329	—
	— - — beyond the 3 fathom curve is	6,445	—
7.	— — - *the small waters west of Mors* at the daily height of water is	9,569	—
	— - — beyond the 3 fathom curve is	415	
8.	— — - *Sallingsund* (together with *Lysen)* at the daily height of water is	7,661	—
	— — - — beyond the 3 fathom curve is	3,697	—
9.	— — - *Liv-Bredning* at the daily height of water is . .	81,655	—
	— - — beyond the 3 fathom curve is . .	52,591	—
10.	— — - *Risgaard-Bredning* at the daily height of water is	9,668	—
	— - — beyond the 3 fathom curve is	6,604	—
11.	— — - *Skive-Fjord* at the daily height of water is . . .	9,844	—
	— — - — beyond the 3 fathom curve is . . .	2,699	
12.	— — - *Louns-Bredning* at the daily height of water is .	17,319	—
	— — - — beyond the 3 fathom curve is .	6,534	—
13.	— — - *the eastern parts of the Limfjord* at the daily height of water is	41,984	—
	— — - — beyond the 1 fathom curve is	13,622	
	— — - — — 3 — is	5,200	—

The whole area of the Limfjord, at the daily height of water*), is c. 288,000 Tonder Land, or about 614 (English) square miles.

Those parts of the Limfjord where the water is 3 fathoms, and deeper, are together 132,783 Tonder Land, or 283 (English) square miles.

These 283 square miles, particularly, afford a suitable dwelling-place for the plaice; for we find here a clean clay bottom, quite destitute of zostera, with large quantities of little bivalves. Of course we find also frequently plaice on shallower water, on $2^1/_2$ and 2 fathoms, nay less than that, but in general we must say that the proper dwelling-places of the larger plaice are beyond the 3 fathom curve. The fry, as it is well known, prefers the quite clean sand, on a few feet of water, but it lives only in the western part of the Limfjord. Only about half of these 283 square miles can, at the present moment, be said to be peopled with plaice.

*) In the Limfjord as well as in the Danish seas within the Skaw the difference between low water and high water by the daily ebb and flow is scarcely one foot.

Appendix II.

On labelling of living Plaice in the Limfjord in 1895.

48 plaice, caught at *Thyboron*, were labelled with a number and placed in *Veno-Bugt* on the 28. April 1895:

Of these were caught again:

No.	Length in Dan. inches when placed in the water.	Caught again in:	Date 1895	Length in Dan. inches when caught again.	Notes.
37	$9^1/_2$"	Veno.	May.	?	
40	9"	—	?	?	
48	$8^3/_4$"	—	6. May.	?	
52	9"	—	May.	?	
58	$9^1/_4$"	—	6. May.	?	
64	$8^1/_2$"	—	June.	?	
69	$8^1/_2$"	Kaas-Bredning.	14. June.	9"	
74	$8^1/_2$"	Veno.	13. July.	$8^7/_8$"	
80	$8^3/_4$"	—	May.	?	
81	7"	—	16. May.	?	
82	$8^1/_2$"	—	24. July.	$9^1/_2$"	
83	8"	—	26. July.	9"?	
84	$8^1/_2$"	—	1. July.	9"	

152 plaice, caught in *Veno-Bugt*, were labelled with a number and placed in *Veno-Bugt* on the 28. April 1895.

Of these were caught again:

No.	Length in Dan. inches when placed in the water.	Caught again in:	Date 1895.	Length in Dan. inches when caught again.	Notes.
87	$8^{1}/_{2}$"	?	?	?	
88	$7^{3}/_{4}$"	Veno.	11. July.	$8^{3}/_{4}$"?	
90	$8^{1}/_{4}$"	—	3. Aug.	$9^{1}/_{2}$"	
91	9"	—	11. July.	9"	
92	$8^{1}/_{2}$"	—	1. Aug.	$9^{3}/_{4}$"	
99	$8^{1}/_{2}$"	—	25. Sept.	$9^{1}/_{4}$"	
103	$7^{1}/_{4}$"	?	?	?	
104	8"	Veno.	27. July.	$9^{1}/_{4}$"	
108	$9^{3}/_{4}$"	—	19. July.	11"	
116	9"	—	20. Nov.	$9^{3}/_{4}$"	
121	$9^{1}/_{2}$"	?	June.	?	
127	$7^{3}/_{4}$"	Veno.	26. July.	$8^{1}/_{4}$"	
129	$8^{1}/_{4}$"	—	11. July.	$9^{1}/_{4}$"	
130	$8^{1}/_{4}$"	—	11. July.	9"	
134	9"	—	17. Aug.	$9^{1}/_{4}$"	
139	$8^{1}/_{2}$"	—	26. July.	$9^{1}/_{4}$"	
141	$9^{1}/_{2}$"	—	Oct.	$11^{1}/_{2}$"	
144	9"	—	17. Aug.	$10^{2}/_{3}$"	
146	$7^{1}/_{2}$"	—	3. Aug.	$9^{1}/_{4}$"	
175	$8^{1}/_{2}$"	—	30. July.	$9^{1}/_{2}$"	
178	$8^{1}/_{4}$"	-	6. May.	?	
181	$7^{1}/_{2}$"	?	31. Aug.	?	
182	9"	Veno.	16. May.	?	
183	9"	—	26. May.	11"	
184	$8^{1}/_{2}$"	--	28. June.	$9^{1}/_{4}$"	
195	$7^{3}/_{4}$"	—	10. Oct.	$11^{1}/_{2}$"	
202	$8^{1}/_{2}$"	--	26. July.	$9^{3}/_{4}$"	
215	$7^{1}/_{2}$"	—	19. July.	$9^{1}/_{2}$"	
223	$8^{3}/_{4}$"	—	24. Aug.	$10^{1}/_{4}$"	
225	$9^{1}/_{4}$"	Kaas-Bredning.	10. July.	10"	
227	$8^{1}/_{4}$"	Veno.	29. June.	$8^{1}/_{2}$"	
232	8"	—	10. Aug.	$9^{1}/_{4}$"	
236	$8^{3}/_{4}$"	—	19. July.	$9^{1}/_{2}$"	

164 plaice, caught partly in *Veno-Bugt*, partly at *Thyboron*, were labelled with a number and placed in *Thisted-Bredning* on the 29. April 1895.
Of these were caught again:

No.	Length in Dan. inches when placed in the water.	Caught again in:	Date 1895.	Length in Dan. inches when caught again.	Notes.
238	8″	Thisted-Bredning.	15. Aug.	$11\frac{1}{4}$″	
242	$9\frac{3}{4}$″	—	June.	»	242, the only one caught again of those that were taken at Thyboron.
261	8″	»	2. Aug.	$10\frac{1}{4}$″	
272	9″	—	6. July.	11″	
274	$7\frac{1}{4}$″	—	June.	»	
277	$8\frac{3}{4}$″	—	June.		
279	?	—	21. Aug.	$12\frac{1}{2}$″	
280	$7\frac{3}{4}$″	»	3. Aug.	11″	
283	$8\frac{1}{4}$″	—	21. Nov.	$13\frac{1}{4}$″	
298	$8\frac{1}{4}$″	—	28. Oct.	$12\frac{1}{4}$″	
305	$8\frac{3}{4}$″	—	28. Oct.	$13\frac{1}{4}$″	
309	$7\frac{3}{4}$″	—	30. July.	$10\frac{1}{4}$″	
311	9″	—	2. Aug.	$11\frac{1}{4}$″	
317	$7\frac{3}{4}$″	—	15. July.	$9\frac{3}{4}$″	
321	8″	—	2. Aug.	$10\frac{1}{2}$″	
324	$8\frac{1}{4}$″	—	24. July.	$10\frac{1}{2}$″	
326	$8\frac{1}{2}$″?	—	11. July.	$11\frac{1}{4}$″	
332	$8\frac{3}{4}$″	—	2. July.	$9\frac{3}{4}$″	
347	$9\frac{1}{2}$″	—	June.	»	
348	$7\frac{3}{4}$″	—	8. July.	$9\frac{3}{4}$″	
356	$7\frac{1}{4}$″	—	21. Aug.	$12\frac{1}{2}$″	
359	$8\frac{3}{4}$″	—	June.	»	
360	9″	—	3. Aug.	11″	
362	$9\frac{1}{2}$″	—	23. Nov.	14″	
364	8″	—	6. July.	10″	
365	$8\frac{1}{2}$″	—	June.	»	
383	$9\frac{1}{2}$″	—	27. July.	$11\frac{3}{4}$″	
386	$9\frac{1}{2}$″	—	16. May.	»	
389	$9\frac{1}{2}$″	—	19. July.	$11\frac{1}{2}$″	
393	9″	—	June.	»	
394	$9\frac{1}{2}$″	—	5. July.	$10\frac{1}{4}$″	
397	$9\frac{1}{2}$″	—	28. Oct.	$12\frac{1}{4}$″	
?	?		18. July.	$10\frac{1}{4}$″	

On the 28. October 1895, finally, a plaice was delivered to me, which had been caught in Thisted-Bredning, and was labelled with No. 503. This is the only fish delivered to me this year of those that were labelled in 1894. When placed in the water in the spring 1894 it measured 9 inches, now it was $16\frac{3}{4}$.

Appendix III.

Daily Accounts

of

The Plaice Fishery

in

Venø-Bugt, Kaas-Bredning, and Lavbjerg-Bredning

from

1. September—31. December 1895.

These Accounts, p. p. 38—47, have kindly been placed at the disposal of the Biological Station by Mr. A. *Tranum*, Assistant-Inspector.

The Average Results

of the Fishery with Plaice-seines and Plaice-nets in *Veno-Bugt* from 1. September—31. December 1895.

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
September.	1	Holiday.	Holiday.	
—	2	4 fourscore per boat.	5 fourscore per boat.	
—	3	6 —	5 -	
—	4	4 —	4 —	
—	5	5 —	5 —	
—	6	7 —	5	
—	7	9 —	6 -	
	8	Holiday.	Holiday	
	9	11 —	7	
	10	11 —	8	
	11	10 —	5 —	The average number of boats that have fished with plaice-seines in Veno-Bugt in the month of September is estimated at c. 60 a day, with a crew of 2 men.
—	12	10 —	5 —	
	13	10 —	10 —	
	14	10 —	11½ —	
	15	Holiday.	Holiday.	The average number of boats that have fished with plaice-nets in Veno-Bugt in the same time is estimated at 30, with a crew of 2 men.
—	16	10 —	11 —	
	17	10 —	11 —	
	18	10 —	6½ —	
	19	Stiff breeze, no fishery.		The price of plaice from Veno-Bugt has, in the month of September, varied from 2—2½ Kroner per fourscore at the fishing-place. Weight: c. 12 lbs. per score.
	20	do.	do.	
	21	15 —	8 —	
	22	Holiday.	Holiday.	
	23	11 —	6	
—	24	7½ —	8 —	
—	25	8 —	7	
	26	5½ —	7	
—	27	5 —	4	
—	28	5 —	4 —	
	29	Holiday.	Holiday.	
—	30	5 —	7	
October.	1	5 —	8 —	
	2	3 —	9 -	
	3	5 —	8 —	The number of boats that have fished with plaice-seines in the month of October is estimated at c. 54, and of boats that have carried on net-fishery at ca. 36.
	4	4 —	8 —	
	5	Stiff breeze, no fishery.		
	6	Holiday.	Holiday.	
	7	7 —	9	

Month.	Date.	Plaice-seines.		Plaice-nets.		Notes.
October.	8	6 fourscore per boat.		7 fourscore per boat.		The price has, in the month of October, varied from $2^1/_2$—3 Kroner per fourscore at the fishing-place. Weight: 12 lbs. per score.
	9	5		8		
	10	4		5		
	11	Stiff breeze, no fishery.				
	12	do.		do.		
	13	Holiday.		Holiday.		
	14	Stiff breeze, no fishery.				
	15	3	—	6	—	
	16	3	—	12	—	
—	17	4		10		
	18	6		6		
	19	6		6		
	20	Holiday.		Holiday.		
	21	6		3		
	22	Stiff breeze, no fishery.				
	23	6		6	—	
	24	6	—	7	—	
	25	5		6		
	26	6		6	—	
—	27	Holiday.		Holiday.		
	28	5		4	—	
—	29	5		3	—	
	30	5	—	3		
	31	3		3	—	
November.	1	2		2		
	2	2^1		2	—	
	3	Holiday.		Holiday.		
	4	3		$1^1/_2$	—	
	5	Stiff breeze, no fishery.				
	6	do.		do.		
	7	2			»	The average number of boats that have fished with plaice-seines in Venø-Bugt in the month of November may be estimated at 30, and of boats that have used plaice-nets at 35. The price has, in the month of November, been 3 Kroner per fourscore. Weight: 11 lbs. per score.
	8	1^1			»	
	9	$1^1/_4$			»	
	10	Holiday.		Holiday.		
	11	Stiff breeze, no fishery.				
	12	do.		do.		
	13	»			»	
—	14	»			»	
—	15	»			»	
	16	»			»	
	17	Holiday.		Holiday.		

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Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
November.	18	»	2 fourscore per boat.	
—	19		2	
	20	»	2	
	21	»	1½	
	22	Stiff breeze, no fishery		
	23	do.	do.	
	24	Holiday.	Holiday	
	25	2	— 2½	
	26	2	— 4½	
	27	2	— 5	—
	28	2	— 7	
	29	1½	— 6	
	30	5½	— 5	—
December.	1	Holiday.	Holiday.	
—	2	4	— 7	
	3	Stiff breeze, no fishery.		
—	4	do.	do.	
—	5	do.	do.	
—	6	do.	do.	
—	7	do.	do.	
	8	Holiday.	Holiday.	
	9	No fishery for plaice.		
—	10	do.	do.	
	11	2	»	
	12	1½	— »	
	13	Stiff breeze, no fishery.		The average number of boats that have fished with plaice-seines in Venø-Bugt in the month of December may be estimated at 8, and of boats that have used plaice-nets at 10.
	14	2	»	
	15	Holiday.	Holiday.	
	16	1	— »	
—	17	1½	— »	
—	18	Very little plaice fishery.		The price has, in the month of December, been 3 Kroner per fourscore. Weight: ca. 11 lbs. per score.
	19	do.	do.	
	20	do.	do.	
	21	do.	do.	
—	22	Holiday.	Holiday.	
—	23	Very little plaice fishery.		
	24	do.	do.	
—	25	Holiday.	Holiday.	
	26	do.	do.	
	27	Very little plaice fishery.		
	28	do.	do.	

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
December.	29	Holiday.	Holiday.	
—	30	Very little plaice fishery.		
—	31	do.	do.	

The Average Results

of the Fishery with Plaice-seines and Plaice-nets in *Kaas-Bredning* from 1. September - 31. December.

Month.	Date.	Plaice-seines.		Plaice-nets.		Notes.
September.	1	Holiday.		Holiday.		
	2	8 fourscore per boat.		7 fourscore per boat.		
—	3	10	—	6	—	
—	4	15	—	6	—	
—	5	15	—	6		
—	6	15	—	7		
—	7	15	—	7	—	The average number of boats that have fished with plaice-seines in Kaas-Bredning in the month of September is estimated at c. 90 a day, with a crew of 2 or 3 men.
	8	Holiday.		Holiday.		
—	9	14	—	7	—	
—	10	12	—	7	—	
—	11	12	—	6	—	
—	12	11	—	6	—	The average number of boats that have fished with plaice-nets in Kaas-Bredning in the same time is estimated at c. 8, with a crew of 2 men.
—	13	11	—	6	—	
—	14	11	—	7	—	
—	15	Holiday.		Holiday.		
—	16	11	—	7	—	The price of plaice from Kaas-Bredning has, in the month of September, varied from $1^1/_2$—2 Kroner per fourscore. Weight: 11 lbs. per score.
—	17	11	—	7	—	
	18	$6^1/_2$	—	7	—	
—	19	Stiff breeze, no fishery.				
—	20	do.		do.		
—	21	7	—	5	—	
—	22	Holiday.		Holiday.		
—	23	6	—	6	—	
	24	8	—	7	—	
—	25	7	—	6		
—	26	7	—	6		
—	27	4	—	6		

Month.	Date.	Plaice-seines.		Plaice-nets.		Notes.
September.	28	4 fourscore per boat.		6 fourscore per boat.		
	29	Holiday.		Holiday.		
	30	Stormy weather, no fishery of importance.				
October.	1	do.		do.	do.	
	2	do.		do.	do.	
	3	5	—	5		
—	4	5	—	5½	—	
—	5	Stiff breeze, no fishery.				
—	6	Holiday.		Holiday.		
	7	3	—	5	—	
—	8	3	—	4	—	
—	9	2	—	4	—	
-	10	3½	—	4	-	
	11	Stiff breeze, no fishery.				
	12	do.		do.		
—	13	Holiday.		Holiday.		
—	14	Stiff breeze, no fishery.				
	15	3	—	4	—	The average number of boats that have fished with plaice-seines in Kaas-Bredning in the month of October is estimated at c. 60 a day, with a crew of 2 men.
	16	3½	- -	4	—	
	17	5½	—	4	—	
	18	6	—	4	—	
—	19	6	—	4½	—	
—	20	Holiday.		Holiday.		The number of boats that have used plaice-nets in the same time is estimated at c. 30, with a crew of 2 men.
	21	6½	—	4	—	
—	22	Stiff breeze, no fishery.				
	23	4	—	4	—	The price has varied from 2—2¼ Kroner per fourscore at the fishing-place. Weight: c. 11 lbs. per score.
	24	4	—	2	—	
	25	5	—	2	-	
	26	6	—	3	—	
	27	Holiday.		Holiday.		
	28	6	—	2¼	—	
	29	4	—	2		
	30	5	—	2		
—	31	3	—	2		
November.	1	2	—	2	--	
	2	2	—	2	—	
	3	Holiday.		Holiday.		
	4	1¼	—	2		
	5	Stiff breeze, no fishery.				
	6	do.		do.		

Month.	Date.	Plaice-seines.		Plaice-nets.		Notes.
November.	7	2 fourscore per boat.		2½ fourscore per boat.		
—	8	2¼	—	2		
—	9	2	—	2	—	
—	10	Holiday.		Holiday.		
—	11	Stiff breeze, no fishery.				The average number of boats that have fished with plaice-seines in Kaas-Bredning in the month of November is estimated at 30. The number of boats that have fished with plaice-nets is estimated at 25. The price has been 3 Kroner per fourscore. Weight: c. 12 lbs. per score.
—	12	do.		do.		
	13	1½	—			
	14	1				
	15	1½	—			
—	16	Stiff breeze, no fishery.				
	17	Holiday.		Holiday.		
	18	1¼	—			
	19	2½	—			
—	20	1¼	—			
—	21	2¼				
	22	Stiff breeze, no fishery.				
—	23	do.		do.		
—	24	Holiday.		Holiday.		
—	25	2½				
—	26	3	—	4	—	
—	27	3	—	4	—	
	28	3	—	4		
—	29	4	—	4		
—	30	6	—	4	—	
December.	1	Holiday.		Holiday.		
—	2	3	—	4	—	
—	3	4	—	4		
—	4	Stiff breeze, no fishery.				
—	5	do.		do.		
	6	do.		do.		
	7	do.		do.		
—	8	Holiday.		Holiday.		
—	9	No fishery.				
—	10	do.				
—	11	do.				
—	12	2	—			
—	13	Stiff breeze, no fishery.				
—	14	2	—	1½	—	The average number of boats that have fished with plaice-seines in Kaas-Bredning in the month of December is estimated at 30, and of boats that have used plaice-nets at 20.
—	15	Holiday.		Holiday.		
	16	1	—	1	—	
—	17	1	—	1	—	

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
December.	18	Very little plaice fishery.		The price has been 3 Kroner per fourscore. Weight: ca. 12 lbs. per score.
	19	do.	do.	
	20	do.	do.	
—	21	do.	do.	
—	22	Holiday.	Holiday.	
—	23	Very little plaice fishery.		
	24	do.	do.	
	25	Holiday.	Holiday.	
	26	do.	do.	
	27	3 —	2	
	28	4 —	2	
	29	Holiday.	Holiday.	
	30	3 —	2 —	
—	31	2 —	2 —	

The Average Results

of the Fishery with Plaice-seines and Plaice-nets in *Lavbjerg-Bredning* together with *Oddesund* from 1. September—31. December 1895.

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
September.	1			
	2			
	3			
	4			
—	5			
	6			
	7			
	8			
	9			
	10			
	11			
—	12			The fishery with plaice-seines and plaice-nets in Lavbjerg-Bredning and Oddesund in the month of September, this year, has been of very little importance.
—	13			
	14			
	15			
	16			

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
September.	17			
—	18			
	19			
	20			
	21			
	22			
	23			
	24			
	25			
	26			
	27			
	28			
	29			
—	30			
October.	1			
—	2			
	3			
	4			
	5			
—	6	Holiday.	Holiday.	
—	7	7 fourscore per boat.	»	
—	8	9 —		
	9	9 —		
—	10	8 —		
—	11	Stiff breeze, no fishery.		
—	12	9 —		
	13	Holiday.	Holiday.	
—	14	Stiff breeze, no fishery.		
—	15	10 —	»	The fishery with plaice-seines and plaice-nets in Lavbjerg-Bredning and Oddesund in the month of October, this year, has been of very little importance.
	16	9 —	»	
—	17	10 —	»	
	18	6		
—	19	7 —	»	The average number of boats that have fished with plaice seines in October may be estimated at 15 a day, with a crew of 2 or 3 men, and the price has varied from $1^1/_2$—2 Kroner per fourscore at the fishing place. Weight: c. $8^1/_2$—9 lbs. per score.
—	20	Holiday.	Holiday.	
—	21	6 —	»	
—	22	Stiff breeze, no fishery.		
—	23	5 —	»	
	24	6 —	»	
	25	3 —	»	
—	26	3 —	»	
—	27	Holiday.	Holiday.	

Month.	Date.	Plaice-seines.		Plaice-nets.		Notes.
October.	28	2½ fourscore per boat.				
	29	3	—			
—	30	3	—			
—	31	2	—			
November.	1	2	—			
—	2	2½				
—	3	Holiday.		Holiday.		
	4	4	—			
	5	Stiff breeze, no fishery.				
	6	do.		do.		
	7	3	—	4	—	
—	8	4	—	4	—	
	9	3	—	4	—	
	10	Holiday.		Holiday.		
	11	Stiff breeze, no fishery.				The average number of boats that have fished with plaice-seines in Lavbjerg-Bredning in the month of November may be estimated at 60, the number of plaice-net boats at 20.
—	12	do.		do.		
	13	3½	—	2	—	
	14	3½	—	2	—	
—	15	4	—	3	—	
—	16	Stiff breeze, no fishery.				The price has been 2¼ Kroner per fourscore.
	17	Holiday.		Holiday.		Weight: c. 9 lbs. per score.
	18	3	—	2	—	
	19	3	—	2	—	
	20	3	—	3	—	
—	21	4	—	3	—	
—	22	Storm, no fishery.				
	23	do.				
	24	Holiday.		Holiday.		
	25	4	—	2		
	26	4	—	5		
—	27	4	—	6		
	28	4	—	5	—	
—	29	4½	—	5	—	
—	30	5½	—	4	—	
December.	1	Holiday.		Holiday.		
—	2	5	—	4		
	3	Storm, no fishery.				
	4	do.				
	5	do.				
	6	do.				
—	7	do.				

Month.	Date.	Plaice-seines.	Plaice-nets.	Notes.
December.	8	Holiday.	Holiday.	
	9	Storm, no fishery.		
	10	do.	do.	
	11	3 fourscore per boat.	2 fourscore per boat.	
	12	2 —	2	
	13	Storm, no fishery.		
	14	1	2	
	15	Holiday.	Holiday.	
	16	1 —	1	
	17	1	1	
	18	Scarcely any plaice fishery.		
	19	do.	do.	The average number of boats that have fished with plaice-seines in Lavbjerg-Bredning in the month of December may be estimated at 30, and the number of boats that have used plaice-nets at 30.
	20	do.	do.	
	21	do.	do.	
	22	Holiday.	Holiday.	
	23	Very little plaice fishery.		
	24	do.	do.	
	25	Holiday.	Holiday.	The price has been $2^{1}/_{2}$ Kroner per fourscore. Weight: c. 9 lbs. per score.
	26	do.	do.	
	27	Very little plaice fishery.		
	28	do.	do.	
	29	Holiday.	Holiday.	
	30	3 —	2	
	31	3	2	

In **Veno-Bugt**, according to this statistics they fished consequently, in 1895, in

September	907,200	plaice	with	seines	and	374,400 with nets,
October	466,560	—	—		-	411,840 —
November	72,600	—	—		-	120,400 —
December ...	7,040	—	—		-	5,600 —
Together	1,453,400	plaice	with	seines	and	912,240 with nets.

Together, in Veno-Bugt, 2,365,640 plaice.

In **Kaas-Bredning**, according to this statistics, they fished consequently, in 1895, in

September...	1,587,600	plaice	with	seines	and	90,240 with nets,
October.	427,200	—	—		-	172,800 —
November...	109,200	—	—		-	65,000 —
December ...	60,000	—	—		-	31,200 —
Together	2,184,000	plaice	with	seines	and	359,240 with nets.

Together, in Kaas-Bredning, 2,543,240 plaice.

In **Lavbjerg-Bredning**, according to this statistics, they fished consequently, in 1895, in

September...	»	plaice	with	seines	and	» with nets,
October	141,000	—	—		-	» —
November...	328,800	—	—		-	89,600 —
December ...	45,600	—	—		-	38,400 —
Together	515,400	plaice	with	seines	and	128,000 with nets.

Together, in Lavbjerg-Bredning, 643,400 plaice.

In all three waters together they fished in seines . . . 4,152,800 plaice
in nets . . . 1,399,480 do.

Together . . . 5,552,280 plaice.

As the average price has been c. 2 Kroner per fourscore, they have fished, consequently, for **138,807** Kroner. — If we estimate the average weight at 11 lbs. per score, they have fished **3,053,754** lbs. of plaice.

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Table II.

Tælning ved Vaadfiskeri af

The Stock of Plaice estimated by seining at 8 various places in *Nissum-Bredning*.

Dan. inches. 3.—6. October 1895. Plaice-seines with small meshes. 100 fth. lin. on each arm. Dan. inches

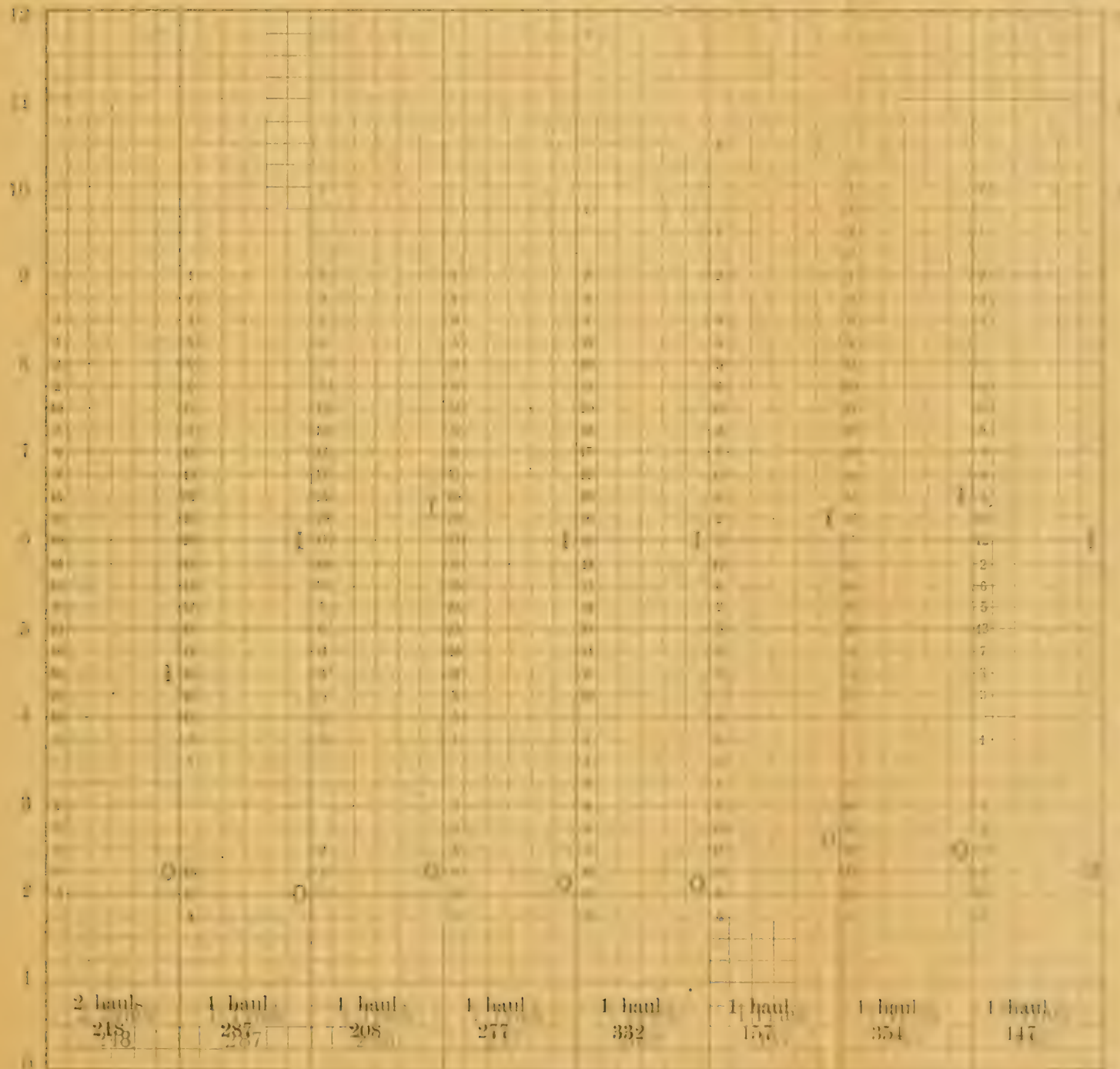

Table II.

The Stock of Plaice estimated by seining at 8 various places in Nissum-Bredning.

Dan. inches. 3.—6. October 1895. Plaice-seines with small meshes. 100 fth. line on each arm. Dan. inches.

2 hauls	1 haul	1 haul	1 haul	1 haul	1 haul	1 haul	1 haul
218	287	208	277	382	187	364	147

Tabel II.

Tælning ved Vaadfiskeri af

Rødspættebestandens Størrelse paa 8 forskellige Steder i *Nissum-Bredning*.

Tommer — d. 3—6. Oktober 1895. Smaamasket Snurrevaad 100 Fv. Line paa hver Arm. — Tommer